

REMARKS

The Examiner is thanked for the examination of the application and for the indication of allowable subject matter in claims 2, 3, 6, 7, 12 – 13, 18 – 19, and 25. However, in view of the foregoing amendments and the following remarks, the Examiner is respectfully requested to reconsider and withdraw the rejections.

The Examiner is also thanked for the courtesy of the interview granted Applicants' attorney on December 5, 2006 and the telephone interview on December 27, 2006. At the December 5, 2006 interview, the amendment to the last paragraph of claim 1 was discussed. However, no agreement was reached as the Examiner indicated that the amendment to the last paragraph of claim 1 was not sufficient. At the telephone interview of December 27, 2006, the Examiner suggested amending the claims as now amended by adding the third paragraph from the end of claim 1.

Claims 1, 4, 9, 14, 15, 20-24, 26 and 28 have been rejected as allegedly being obvious over JP 11-168094, hereinafter *Yuda*, in view of USP 6,086,677, hereinafter *Umotoy*, and further in view of USP 5,102,523, hereinafter *Beisswenger*.

The foregoing amendments better define the interior of the claimed dividing plate. Specifically, the now amended claims 1, 9, 15, and 21 now recite that the internal space is divided into first and second diffusion sections by a middle one of the plates, and the middle plate includes a plurality of distribution holes interconnecting the first and second diffusion sections, wherein the first diffusion section includes an inlet through which the precursor gas is introduced into the first diffusion section, and the second diffusion section includes a plurality of discharge holes through which the diffused precursor gas can enter the film deposition process

space. Support for the amendments may be found at paragraph [0039] of the published application. However, the claimed invention is not limited to the disclosed embodiments.

As now amended, the dividing plate enables the precursor gas to be thoroughly diffused before it enters the film deposition process space by circulating the precursor gas through the first and second diffusion sections, including through the distribution holes in the middle plate. Such features, in combination with the remaining claim elements, are not taught or suggested by the applied prior art.

For purposes of completeness, additional arguments against the current rejection are set forth herein. Many of the following arguments have been discussed with the Examiner and/or submitted on October 31, 2006.

The Examiner alleges that *Yuda* discloses the dividing plate as claimed, with certain exceptions, including the fact that the claimed dividing plate is arranged in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film deposition process space is through the plurality of holes extending through the dividing plate. This point is conceded by the Examiner: "*Yuda* et al. and *Umotoy* et al. fail to teach the dividing plate is arranged in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film deposition space is through the plurality of holes."

(Page 3, emphasis added)

The fact that the dividing plate is arranged in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film deposition process space is through the plurality of holes extending through the

dividing plate is significant so that beneficial relative pressures can be maintained in the respective portions of the vacuum chamber so that the flow of gases through the dividing plate can be effectively controlled to achieve a desired distribution of gases and gas pressures to minimize the likelihood that precursor gases will enter the plasma discharge space. Note the last paragraph of the independent claims, wherein the relationship $uL/D > 1$, which requires relative pressure between the two divided spaces in order to maintain the relationship. Regardless of the individual values of the variables, some pressure relationship will be required between the two chambers to maintain the cited relationship. And, ***that pressure relationship can be easily maintained by arranging the dividing plate in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film deposition process space is through the plurality of holes extending through the dividing plate.***

As evidence of the importance in controlling air flow to meet $uL/D > 1$, the Examiner's attention is directed to U.S. Patent Nos. 6,245,396 and 6,892,669, which disclose partitioning plates with 500 through-holes, each having a diameter of about 0.5 mm. This is a total area of about 785mm^2 . Since the substrate is 370 X 470 mm^2 , the partition plate is likely the same size. ***This means that only about 0.45% of the partition plate is provided with through holes.*** Thus, it should be clear that in order to control the flow of fluids through the small through-holes, it is important to have the dividing plate arranged in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film

deposition process space is through the plurality of holes extending through the dividing plate.

To overcome this deficiency, the Examiner relies upon *Beisswenger*, alleging that it would have been obvious to provide “seals for arranging the dividing plate such that the only communication between the plasma discharge space and the film deposition process space is through the plurality of holes...in order to prevent gases from escaping upwards as taught by *Beisswenger et al.*” The Office Action further states that “One would be motivated to combine the aforementioned feature with the disclosure of Yuda as the apparatus of Yuda is designed so that gases travel in a downwards direction and are then used on a processing surface of the substrate. Gases flowing in the opposite direction would be counterproductive.” Page 6, paragraph 36.

In response to that argument, applicants submit that there is no suggestion anywhere in Yuda that the gases might flow upwards. Specifically, in Yuda, the location of the inert gas nozzles 28 interspaced with the reaction gas nozzles 27 prevents any improper or premature mixing of the reaction gas with the oxygen radicals. Accordingly, there is no need to use the “seals” of *Beisswenger* to control the flow of the gases. The specific arrangement of the inert gas nozzles 28 interspaced with the reaction gas nozzles 27 solves any potential problems.

In addition, in *Beisswenger*, the gases must flow in opposite directions, up through 58 – 64 and down through 48 – 54. In *Beisswenger*, the flow direction must be opposite and the flows must be separated. There is no other choice. This is a very different construction than Yuda.

In both the present invention and in Yuda, it is desired to control the interaction between the radicals and the material gas. However, this is accomplished in very different ways. Specifically, in Yuda, it is accomplished by the arrangement of the inert gas nozzles, and in the present invention, by maintaining the relationship $uL/D > 1$. Two other facts are important. First, there is no teaching or suggestion that Yuda's method is insufficient, and thus needs improving. Second, it is not clear how using seals from *Beisswenger* would improve the interaction between the radicals and the material gas in the Yuda device. Accordingly, there is clearly no motivation or suggestion to modify Yuda in the manner suggested in the Office Action. The proposed combination is merely based on the improper use of hindsight, using the elements of the claims as a shopping list to find the features separately in the prior art.

Furthermore, none of the three applied references are concerned with maintaining a proper pressure relationship between a plasma discharge space and a film deposition process space. In particular, as previously argued, the seals in *Beisswenger et al* relied upon by the Office Action are not between the plasma discharge space and the film deposition process space.¹ Accordingly, the seals 65, 66 do not in any way contribute to a separation between a plasma discharge space and a film deposition process space.

It is, in part, the recognition of the desirability of maintaining the relationship $uL/D > 1$ that is accountable for the present invention. Without this realization, there

1. In *Beisswenger et al*, the plasma is generated in the space between the plate 46 and the electrode 22, and the film is also generated in the space below the plate 46.
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would have been no motivation to combine the prior art in the manner suggested by the examiner.

Umotoy is relied upon for its alleged teaching of a distribution plate having separate passages extending therethrough and fusing together the plates of the distribution plate. However, *Umotoy* relates to a showerhead arrangement that delivers two different reagents, e.g., titanium tetrachloride and ammonia to a process region 104. In *Umotoy*, the showerhead is not used to separate a plasma generating section from a film forming section below the showerhead. Also, unlike the present invention and *Yuda*, *Umotoy* does not even use plasma for the processing.

Applicants submit that *Yuda* and *Umotoy* operate sufficiently differently from each other so that one of skill in the art would not be motivated to combine the references, as proposed by the examiner. The mere fact that *Umotoy* teaches the use of o-rings does not present a suggestion to use such o-rings in every plate. As stated in § 2143.01 of the Manual of Patent Examining Procedure, the mere fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness. Motivation for the modification or combination must be present in addition to mere technological possibility. In this case, the Examiner has failed to provide a motivation for using the o-rings of *Umotoy* in the system disclosed by *Yuda*. This is particularly true since *Yuda* does not identify any problems with the plates or gas injectors and certainly does not teach or suggest sealing such plates with o-rings. Accordingly, since *Yuda* does not teach sealing its plates with o-rings, and does not identify any other problems with the plates, there would not be any motivation to “avoid the use of o-rings” as alleged in paragraph 6 of the Official

Action. Accordingly, as set forth in the attached Declaration of Mr. Nogami, there would be no reason to modify *Yuda* based on *Umotoy* as alleged in the Official Action.

Furthermore, the independent claims define that the plurality of holes are formed so as to satisfy the condition $uL/D > 1$ during operation of the apparatus, where u is the gas flow velocity inside the holes, L is the effective length of the holes, and D is the gas interdiffusion coefficient. This relationship is significant with respect to the aforementioned feature that the dividing plate is arranged in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film deposition process space is through the plurality of holes extending through the dividing plate so that beneficial relative pressures can be maintained in the respective portions of the vacuum chamber so that the flow of gases through the dividing plate can be effectively controlled to achieve a desired distribution of gases and gas pressures to minimize the likelihood that precursor gases will enter the plasma discharge space.

The fact that *Umotoy* teaches that flow is related to hole size is far different than the foregoing teaching of the claimed relationship. For example, to achieve the relationship $uL/D>1$, a pressure must be used. This relationship is used to prevent backflow of the gases through the holes. In order to achieve this pressure, it is important to prevent flow around the edges of the dividing plate. Accordingly, the Applicants submit that this feature, and the relationship $uL/D>1$ as used in the present claims in particular, is also not taught by *Umotoy* or the other cited prior art.

The Examiner is reminded that “[o]bviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one or ordinary skill in the art.” See MPEP 2143.01. Further, “[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.”

It should also be noted that MPEP § 2143 clearly defines that to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a), three basic criteria must be met: 1) there must be some suggestion or motivation, either in the references or in the knowledge generally available, to modify or combine the reference teaching, 2) there must be a reasonable expectation of success, and 3) the prior art references must teach or suggest all the claim limitations.

In this case, all three references relied upon by the examiner operate in a significantly different manner from each other, and none of the references are concerned with the problems to be solved by the present invention. Thus, it is only with the benefit of hindsight of the present application that the examiner was able to piece together a combination of prior art. Accordingly, the rejection is improper and should be withdrawn.

The remarks set forth above with respect to claim 1 also apply to the remaining independent claims.

Claims 4, 14, 20-24, 26, and 28 depend from the independent claims and are thus patentable at least for the reasons set forth above.

Accordingly, the Examiner is respectfully requested to withdraw the rejections of claims 1, 4, 9, 14, 15, 20-24, 26, and 28.

Claims 10, 11, 16, and 17 have been rejected under 35 U.S.C. 103(a) as allegedly being obvious over *Yuda*, *Umotoy*, and USP 5,433,786, hereinafter *Hu*. However, the examiner is relying upon *Hu* simply for its alleged teaching of rivets and fasteners. Accordingly, *Hu* does not otherwise overcome the deficiency of the rejections of the independent claims based on *Yuda* and *Umotoy*. Among other things, none of the three references teach or suggest that the dividing plate is arranged in the vacuum reaction chamber such that the only communication between the plasma discharge space and the film deposition process space is through the plurality of holes. Accordingly, the Examiner is respectfully requested to withdraw the rejections of claims 10, 11, 16, and 17.

In the event that there are any questions concerning this response, or the application in general, the Examiner is respectfully urged to telephone the undersigned so that prosecution of the application may be expedited.

Respectfully submitted,

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